



# ***Technology News***

**December 2002**

◇ **USDA Natural Resources Conservation Service** ◇ **Science and Technology** ◇

"NRCS *Technology News*" is an electronic information piece provided by Science and Technology 10 times a year. It is designed to deliver pertinent information to our customers about new technology, products, and services available from the Soil Survey and Resource Assessment and the Science and Technology deputy areas. "NRCS *Technology News*" is in a format that is available to all NRCS field staff.

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## ● MESSAGE FROM THE DEPUTY CHIEFS

**Lawrence E. Clark and Maurice J. Mausbach**

While global climate change has been a contentious issue both politically and scientifically, there are associated factors that affect natural resource management and demand NRCS attention. As scientific evidence mounts to support a human-induced component in climate change, we can no longer cite scientific uncertainty as a basis for lack of action. The risks are too great. Our challenge is to develop reasonable mitigation and adaptation responses that sustain growth in the agricultural economy in the short-term, and at the same time reduce the threat that accompanies unpredictable changes in the climate.

Reducing greenhouse gases (GHGs) in the atmosphere is an important climate change mitigation strategy. Although agriculture contributes a relatively small portion (approximately 7 percent) of the total U.S. emissions, reductions in any sector can have an impact. Fossil fuel use and conversion to cropland are responsible for a modest proportion of the total U.S. carbon dioxide; enteric fermentation by grazing ruminants and manure handling systems together are responsible for about 40 percent of the total methane production; and fertilizer management contributes almost 70 percent of the total nitrous oxide emissions.

Climate change and climate variability, whether natural or human-induced, are a threat to sustainable natural resource management. Seventy years of Agency experience has taught us that unusual climatic events usually result in environmental degradation unless conservation measures are in place. NRCS can deliver conservation technical assistance to farmers and ranchers to help them prepare for and adapt to a more unpredictable climate, such as drought.

NRCS must focus our considerable technical expertise on improving our ability to predict, measure, and monitor changes in ecological processes in natural resource systems. The measurement of soil carbon and other greenhouse gases is a good example. Better on-the-ground decisions and systems that market enhanced ecosystem services require more accurate and precise quantification of change. To meet this objective, NRCS can provide leadership in a number of key areas. Improving our capacity to predict, measure, and monitor changes in soil carbon and other greenhouse gases in response to changes in climate and management is a critical need. Good science and

technology remain the basis of technical assistance to farmers and ranchers, cost effective programs, and relevant policy.

Studies have shown that soils and vegetation can sequester, or store, carbon and there has been a well-deserved focus on carbon sequestration. However, methane and nitrous oxide from agriculture are significant sources of greenhouse gas emissions and, in most respects, improved management practices represent opportunities for farmers to benefit economically. Few staff have a background in GHG management especially as it relates to other resource concerns. We need improved educational and training programs and integrated planning tools. If we expect innovative behavior, staff at all levels need both a sustained commitment and a working knowledge of greenhouse gas dynamics.

Reducing greenhouse gases through managing natural resource systems is a substantial challenge for NRCS. However, in most cases, reduction of GHG emissions is a benefit of applying existing conservation practices and systems. NRCS will continue to improve the science and technology behind our technical assistance to increase our effectiveness.

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## ● CONSERVATIONIST'S CORNER

### **J. Kevin Brown, State Conservationist, Ohio**

The centers, divisions, and institutes of NRCS Science and Technology are providing new products that will enhance our soil survey program and help NRCS Ohio deliver our products and services more efficiently.

The National Cartography and Geospatial Center (NCGC) is providing support to Ohio with digitizing our soil survey so that valuable soils information can be more efficiently provided to customers. So far, 9 soil surveys are digitized and more than 40 soil surveys are in progress. When they are complete, customers will be able to download digital soils data from the Internet. Soil boundaries with labels in four formats will be available, as will all of the tables that we publish in soil survey reports. Customers will also be able to get metadata that explains how all of the data were developed and to what standards. The NCGC has provided valuable map materials that are needed for recompilation work so that we can meet new digitized survey standards.

Recently, the NCGC developed county orthophotomosaics that, when used in Geographical Information Systems (GIS), will serve as conservation planning basemaps for the entire state of Ohio. The NCGC worked with the U.S. Geological Survey (USGS) to develop georeferenced and horizontal scale corrected aerial photos called "DOQQ's" (Digital Ortho Quarter Quadrangles). The DOQQ's are compiled into seamless mosaics for conservation planning basemaps to be used in all of Ohio's 88 counties.

Using specialized software, orthophotography is compressed from five or six CD-ROM's into just one for each county. File compression makes file management much easier and

occupies less hard drive space. The photos are corrected so that everything shows up in the same horizontal scale. Every individual pixel (picture element or dot) is georeferenced so that the computer will recognize the exact geographic location of each pixel on the map. Before the countywide photomosaics were created, planners were frequently struggling with farms with data on more than one CD-ROM. In addition, with raw DOQQ data, a planner may have 30 files to manage. Now, Ohio planners can more easily find and delineate farm tracts, crop fields, and areas of wetland, woodland, and pastureland. Details, such as farmsteads, gullies, oil wells, ponds, and strip mining areas, can be easily located when they are visible on the basemaps. When data is compressed, it does lose some photo-clarity, but the gain is having one CD contain the data of five CDs in a seamless mosaic of georeferenced photos that covers the entire county. The resolution is one meter per pixel.

The Soil Survey Division has designed and maintained a Web site that assists us in managing our soil survey schedule, including tracking our progress. They provide summary reports that we can easily access. With the click of a button, we can check the status of our mapping, our survey updates, and the progress with digitizing. They maintain this Web site for NRCS in all States, for essentially any soil survey product. The address is <http://ssschedule.nrcs.usda.gov> It is password protected and not open to the public, but it is open to NRCS staff who can make good use of it. The Soil Survey Division also provides direction on the type of customer support we can expect to deliver in the future. They develop standards for the implementation of soil survey updates on an MLRA (Major Land Resource Area) basis.

The Soil Quality Institute (SQI) has trained our staff in soil quality definitions and measurements and has provided us with Soil Quality fact sheets for our field offices. SQI staff have come to Ohio and assisted us in remote sensing for soil survey investigations. They have also conducted sampling to demonstrate differences in the soil characteristics under different management, like long-term no-till versus long-term conventional-till.

With the assistance of the centers, divisions, and institutes of NRCS Science and Technology, we are finding better ways to serve our customers and to more effectively deliver our conservation program in Ohio.

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## ● **NEW PRODUCTS AND SERVICES**

### **#1 Cold Soil Data Available on CD**

The impact of fuel spills on the cold soils in Antarctica has been under study by the National Soil Survey Center (NSSC) and National Water and Climate Center (NWCC) in

collaboration with scientists in New Zealand. The study, initiated in 1999, uses soil climate stations in three areas: one site is on Ross Island, near Scott Base, one is on the Antarctic coast, and the third is in the dry valleys (an area kept free from snow by high winds). Each site has two stations, one in a spill area and one nearby in a nonspill area for comparison. Hourly averages of soil water content, soil temperature, and atmospheric variables are recorded on dataloggers and retrieved annually.

This study also provides baseline data for global climate change research. Permafrost-affected areas are believed to be the most sensitive to global climate change. The soil climate station data provide valuable information to calibrate and verify models used to predict climate change and its effects.

The immediate use of the project information will be for Antarctica managers to decide whether to ameliorate oil-contaminated soils or let nature repair itself. NRCS will use the information collected to improve soil taxonomy, to classify soils for the proposed Southern Hemisphere Circumpolar Soils Map, and to better understand cold soil behavior.

Data are available on CD from the NSSC. Plans are to make the data available on the NWCC Web site and in various publications, including a Soil Survey Investigations Report.

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## ● TECHNOLOGICAL ADVANCES

### **#2 Effectiveness of Disturbed Forest Land Revegetation Monitored**

Wildfires, combined with extended drought, have devastated millions of acres of forest and grazing lands in the West. Over the past 3 years, more than 272,000 fires occurred on 18.5 million acres across the United States. In the aftermath of the destruction, questions arise: Should intensely burned sites be seeded, and if so, with what species and methods? Will seeding protect soil and water resources and suppress invasive species? Will seeded species impact timber regeneration? NRCS and Plant Materials personnel have been investigating these questions in Montana since 1974; initially with disturbed timberland field evaluation plantings, and more recently with fire-impacted watershed

monitoring studies. Study results and data from the earlier field evaluation plantings suggest that planting properly selected native or introduced forage grass species can provide the benefits of erosion control, weed suppression, and an enhanced forage resource on a variety of sites without significantly affecting the survival of tree seedlings.

In the studies and on the monitoring sites, burned or harvested and mechanically scarified forest sites were seeded with introduced and native grasses (60-80 pure live seeds per square foot, on average). Other sites were left unseeded as study controls. Permanent transects were installed to monitor changes in ground cover and canopy cover by species. Biomass production of seeded species and other vegetation was determined, and tree regeneration was evaluated. Sites were monitored for a minimum of 10 years.

Data show that (1) successfully seeded treatments had little effect on tree seedling survival when compared to control sites, (2) invasive weeds were significantly suppressed by several of the seeded species on some sites, (3) average soil erosion for the 5-year period after successful seedings was about half that of the controls (computed using the Revised Universal Soils Loss Equation-RUSLE), and (4) successful seeding treatments established plant communities nearly as diverse as those on control sites.

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## ● TECHNOLOGY TRANSFER

### **#3 Soil Data Can Contribute to Golf Course Design, Construction, and Maintenance**

The National Soil Survey Center, in cooperation with the University of Nebraska, studied ways that soil data can be applied to support golf course design, construction, and maintenance practices. The study provided an initial assessment of the soil resources, using interpretive maps complemented with Geographic Information System (GIS) analytical tools to show areas with soil characteristics that may be beneficial or disadvantageous to golf course design, construction, and management. A set of thematic maps depicting considerations and concerns was developed using NRCS Soil Data Viewer GIS analytical tools. The initial draft considered erosion during construction and establishment, irrigation design and efficiency, pesticide management, location of source

material (such as topsoil and sand), and identification of suitable landscaping forbs, shrubs, and trees.

For the developer, this information aids the search for sites that can be economically developed as opposed to those that require additional resources to overcome natural constraints and limitations. Architects and builders can use NRCS soil information to take advantage of the site's soil characteristics and create a golfing facility that is economical to build and maintain and yet in harmony with its surrounding environment. Soil data can be used to design and install irrigation and surface and subsurface drainage systems that maximize irrigation and drainage efficacy and do not create an environmental risk to surface and ground water. The builder can locate areas where soil limitations may pose special construction concerns or areas that are potential sources of borrow materials, such as topsoil or sand. For the superintendent, soil data are essential to developing a golf course management plan that not only maximizes the soil's potential to support play, but also enhances the course's contribution to the surrounding environment. As such, soil information is a basic component of any environmentally sound fertility, weed, or pest management system.

Because this was a preliminary proof of concept study, the analyses reflect only a relatively small sampling of the systems analytical capabilities. A more complete assessment will be possible once the golf course requirements of the developer, architect, and superintendent are fully understood and developed.

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● **WEB-BASED TECHNOLOGY**

**#4 Russian Olive Tree Technical Note Available**

Information about the Russian olive, a tree native to Asia and southern Europe that was brought to North America in colonial times, is available on the Plant Materials Web site. Over the years, Russian olive has been widely planted in the Western United States: as an ornamental, in windbreaks, for erosion control, and for wildlife enhancement. Its tolerance of soil salinity and poor soil conditions, ease of establishment, medium size, and edible fruit have made it a recommended conservation species. In some parts of the West, however, especially wet saline riparian and bottomland sites, Russian olive grows

too aggressively and tends to compete with native vegetation, reducing biodiversity and negatively affecting habitat function.

An extensive review of the history, biology, and ecology of Russian olive, as well as information on its control and revegetation of affected bottomland sites, is available online. Technical Note 47, a cooperative effort between Plant Materials Program personnel in Washington, Idaho, and Montana, can be accessed at <http://Plant-Materials.nrcs.usda.gov/pubs/wapmctn470302.pdf>

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## **● TRAINING**

### **#5 “On Leading Change” is December *The Leader in You* Broadcast**

“Seventy percent of the Senior Executive Service will become eligible to retire in the next five years, and more than 50 percent of the Federal workforce will retire during that same time frame,” estimates the General Accounting Office. (1) Although these dramatic changes are recognizable, the reality of how to deal with the changes is a different matter. John Kotter, the Konosuke Matsushita Professor of Leadership at the Harvard Business School, is widely acknowledged as the world’s foremost authority on leadership and change. John Kotter’s seminar, “On Leading Change,” will directly address these difficult issues associated with change in a satellite seminar on Tuesday, December 10, from 11 a.m. to 12:30 p.m. e.t. Taping rights are available.

Kotter has authored *The Heart of Change*, *Matsushita Leadership*, and *Leading Change*. Over the past 20 years, his articles in *The Harvard Business Review* have sold more reprints than any of the hundreds of distinguished authors who have written for that publication during the same period. In his seminar, Kotter will identify critical elements of leadership and the key differences between leadership and management, how leadership and change relate to one another, and what it takes – including practical techniques and tips – to effectively facilitate change.

Part of the ongoing *The Leader in You* leadership development series, the seminar is sponsored by the Social Sciences Institute and National Employee Development Center



in cooperation with the National Association of Conservation Districts, National Association of Conservation District Employees, and the National Association of State Conservation Agencies.

<sup>1</sup> Tanya N. Ballard. "Training Program Seeks to Groom Next Crop of Senior Executives." 22 October 2002. Published by GovExec.com.

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## **#6 Cropland Conservation Planning Course Scheduled for April 2003 Release**

A new conservation planning course has been developed specific to cropland. It focuses on the specific tools and processes used to assess, formulate, and implement cropland resource management systems to address soil, water, air, plant, animal, and human resources. The course complements and builds on the NRCS Conservation Planning Course. It is designed to bring the participant to an understanding skill level (ASK level 2 or 3) for cropland conservation planning.

This new National Employee Development Center course is ideal for employees who have recently completed the conservation planning course and want to improve their proficiency to plan cropland. It will advance the understanding of how resource management systems are formulated against quality criteria and further build conservation planning skills on cropland to more effectively carry out the conservation provisions of the 2002 Farm Bill. In addition, this new course will be of significant benefit to those technical service providers who need either a better understanding of the NRCS conservation planning process on cropland or more in-depth conservation planning training.

The course will be available on the Web and on a CD-ROM. It has an anticipated release date of April 2003.

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## **#7 HEC-RAS Training Scheduled by Support Team**

The Army Corps of Engineers HEC-RAS software for use in projects involving stream hydraulics, water surface profiles, and watershed analysis has been adopted by NRCS. The Conservation Engineering Division and the National Water and Climate Center (NWCC) have organized a HEC-RAS team to support implementation. "Introduction to HEC-RAS," a 3-day course developed by the team, provides an introduction to use of HEC-RAS, with water surface profiles in channels and flood plains, bridge and culvert hydraulics, hands-on example applications, and some specialized features. This introductory HEC-RAS course has already been presented to 227 students in 16 states.

The HEC-RAS team has scheduled training for fiscal year 2003. Based on responses received from the states, introductory courses will be held in Arkansas, Kansas, Maryland, Michigan, Minnesota, Oregon, South Carolina, Texas, Utah, Washington, and Wisconsin. "Advanced Use of HEC-RAS" courses are being planned for Alabama, Kansas, Louisiana, Maryland, Texas, and Utah. Notices will be distributed when dates have been determined.

The team is comprised of three engineers from the NWCC, an engineer from the National Design, Construction and Soil Mechanics Center, and seven engineers from NRCS State Offices. The team maintains a Web site, supports the program through on-line assistance, and provides classroom training. HEC-RAS and associated information may be downloaded through the NWCC Web site, [www.wcc.nrcs.gov](http://www.wcc.nrcs.gov) - select Water Quality and Quantity Sciences, select Hydrology and Hydraulics, select Tools/Models, select HEC-RAS.

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## **● HONORS**

## #8 Deputy Chief Receives 2002 Presidential Rank Award

Lawrence E. Clark, Deputy Chief for Science and Technology, is a recipient of the annual 2002 Presidential Rank Award. The award recognizes Federal senior executives for their strong results-oriented leadership; exceptional professional or scientific long-term accomplishments; and consistent demonstration of strength, integrity, industry, and relentless commitment to excellence in public service. Deputy Chief Clark and a select group of senior career executives were honored with the award in a recent ceremony in Washington, D.C. On behalf of the American people, President George W. Bush expressed to them appreciation for their dedication, and he commended them for their exceptional performance. "It is an incredible honor for me to be the leader of such a strong team..."

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